

# Wireless IP

Strategic Technology  
AirTouch Communications

W. C. Y. Lee, C. Xu and David J. Y. Lee

## Abstract

The cellular network currently undergoes dramatically changes. There are a lot of interests in providing an IP-based backbone for cellular network. Such arrangement has the potential saving by routing packetised voice and data together cheaper and more efficiently. In addition, there are many IP centric applications developed for easier, faster, cheaper and user friendly adoption. However, as we push IP functions further down into cellular network, the issues of mobility management, high speed HO, SHO and roaming have to be addressed in an IP context.

The strategy is to integrate IP based standards for cellular IP solution with cellular centric vs. IP message gateway as the demarcation point. However, some unique features for cellular system might need some innovations for better performance. In this paper, we will propose 4 different solutions for different levels of cellular network IPitization.

Proposal one specifies how existing IP network can be integrated with cellular network by eliminating some key hardware from traditional circuit switching architecture.

Proposal two adopts the current cellular packet data network proposal with enhancement on layer 2 (ATM connections from BSS to HS). The third proposal eliminates BSC and introduces ATM support soft HO. The fourth proposal pushes IP to BTS and hopes the enhancement on QoS of IP layer will be able to support SHO.

Another area that is discussed briefly in this paper is how to integrate no IP address/stack applications (today's voice) with IP address/stack applications for IP based network by inter-working with SS7 based network.

## 1. Introduction

Internet traffic is growing in an exponential rate and more and more people's life are tightly coupled with Internet. A decade from now, businesses will be using data services as casual as they use voice services today [1]. Therefore, an IP-centric wireless network is essential in providing rich and efficient data services to end users. There are several proposals on how to convert current cellular network into IP arena. Although replacing the MSC with fast and powerful router seems already agreed by most vendors, there is no definite conclusion on whether and how IP should be implemented at BSC and BTS.

Before we can decide on how far IP should be pushed forward, we need to understand the functions of each cellular network element. The following are short definitions of each cellular network element's functionality. MSC functions include routing call, inter-working to PLMN and PSTN, call processing and roaming. BSC functions include

## Wireless IP

### Description

There are many different proposals in the literature on how to effectively updates the cellular network to support fast hard HO. It is can support the mobility, HO, AAA (Authentication, Authorization and Accounting) and other cellular network functions. However, there is no solution for supporting CDMA Soft Hand Off (SHO) which this invention covers. ATM is introduced in this invention to address the unique CDMA SHO issue.

This invention proposes four different architectures for IP based cellular network. These architectures eliminate circuit switch based BSC and MSC which form the current cellular/PCS/3G network. The invention defines and analyzes these four different IP based cellular network architecture. Most standard cellular features are supported by these architectures. The specific SHO feature in CDMA system was also discussed among these IP based cellular network. The current air interface from PPP (Point to Point Protocol) is suggested to change to ATM to support the CDMA SHO.

These four architectures are:

1. Replace BSC with router (eliminate MSC and BSC)
2. ATM connection from BSC/router to BTS to handset (support SHO)
3. BTS with IP on top of ATM with HO server to support SHO (Eliminate BSC)
4. BTS with IP (independent of layer 2 - most likely no SHO)

Also the mapping for applications with/without IP addresses is also discussed in this invention.

With 3G and beyond, the bandwidth for cellular application needs wider and wider. ATM might not be an efficient air interface for narrow band application. However, for wide band and QoS sensitive applications, ATM is among one of the best solutions available today. It can provide circuit emulation and QoS, and is multi-media ready. It can also provide layer 2 direct connect within the network (assume the network is ATM based) which can improve the performance drastically. ATM is also IP ready. By using the ATM interface for radio link, it provides end to end guaranteed QoS. Also, network management overhead is imbedded in the SONET header. That makes ATM more attractive since network management has been a significant cost for operation.

### Benefits

Moving IP to BTS is the newest trend in the cellular industry. The architecture for different technologies (CDMA, GSM and TDMA) will be different, and features that will be supported will also be different.

By pushing the IP to BTS, there is no need for BSC and MSC. Hardware in BSS and MSC (transcoder, vocoder, switch and ) can be replaced with routers and DSP. The cost saving on that is quite significant.

Also, the voice on average takes about 4kps of bandwidth. The cost saving is also quite attractive by migrating the cellular network to IP base network.

Both the data and voice will be using the same platform and running on the same network.

ATM support QoS and is multi-media ready. It is also a proven technology and is getting more and more supports from communication industry.

With available applications for IP platform and more and more IP based network functionality, the economic of scale for IP based network will definitely cost less than the traditional circuit based network.

More importantly is the availability of IP based killer applications. It will definitely reshape the wireless data market.

Network operation overhead is in the SONET/ATM header and also is standardized so makes supporting OA&M much easier and cheaper.

This invention provides one possible migration path toward future IP based cellular network. This network is ready for smooth integration with PLMN, PSTN, Internet, Intranet and any IP based network.

#### Competitions

Many vendors are also looking into possible IP based network architecture. It is highly likely that ATM will be used as the layer 2 for IP based cellular network. This proposal also provide a unique solution for CDMA soft HO which will be seeked by competitors.